

## Sources of Exposure

## Toxicokinetics and Biomonitoring

## Biomarkers/Environmental Levels

ToxGuide™

for

4,4'-Methylene-  
bis (2-  
Chloroaniline)  
(MBOCA)

$C_{13}H_{12}Cl_2N_2$

CAS # 101-14-4

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U.S. Department of Health and  
Human Services  
Public Health Service  
Agency for Toxic Substances  
and Disease Registry  
[www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)



**ATSDR**  
AGENCY FOR TOXIC SUBSTANCES  
AND DISEASE REGISTRY

### General Populations

- Members of the general population are not likely to be exposed to MBOCA unless they live in an area that has been contaminated.
- Eating foods grown in contaminated soil may expose you to MBOCA. The compound cannot be removed by rinsing with water.
- Drinking water contaminated with MBOCA is unlikely since it does not dissolve in water.

### Occupational Populations

- If you work with MBOCA, you may breathe small particles of it in the air. It may get on your skin if you brush against a surface covered by MBOCA dust.
- Workers in plants that manufacture or use MBOCA have the potential to be highly exposed by inhalation or dermal contact.

### Toxicokinetics

- MBOCA is absorbed following inhalation, oral, or dermal exposure. However, the extent of absorption (bioavailability) has not been determined.
- MBOCA appears to be widely distributed throughout the body following oral or dermal exposure, with the highest concentration in the liver. No data are available on distribution following inhalation exposure.
- MBOCA is excreted in the urine in humans after occupational exposure (assumed to be dermal and inhalation exposure); however, data on the kinetics of excretion are conflicting. It is unknown if other excretion routes exist in humans (no data). In rats, 60% of an oral dose was excreted in the feces.

### NHANES Biomonitoring

- There are no data regarding the levels of MBOCA in the general population.

### Biomarkers

- MBOCA or its metabolites can be measured in the urine.
- Since MBOCA is rapidly metabolized, its presence in urine indicates recent exposure.

### Environmental Levels

#### *Air*

- Air samples in a residential area with MBOCA contamination indicated only trace levels in the 1980s. There are no recent monitoring data for air levels MBOCA in the United States.

#### *Water*

- In the 1980s, surface water runoff from an MBOCA producer was 1 parts per billion. There are no recent monitoring data for water levels of MBOCA in the United States.

#### *Sediment and Soil*

- MBOCA levels along public roads near a manufacturing plant were 4.6 to 590 parts per million in the 1980s. There are no recent monitoring data for levels of MBOCA in the sediment or soil in the United States.

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2017. Toxicological Profile for 4,4'-Methylenebis(2-Chloroaniline), Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### MBOCA

- 4,4'-Methylenebis(2-chloroaniline) (MBOCA) is a synthetic chemical.
- Pure MBOCA is a colorless, crystalline solid, but the commonly used form is usually yellow, tan, or brown pellets. It has no smell or taste.
- It is used in industry primarily to produce castable polyurethane parts such as gears, gaskets, sport boots, roller skate wheels, and shoe soles. Other uses include rolls and belt drives in cameras, computers and copy machines, and wheels and pulleys for escalators and elevators. MBOCA may be present in components in home appliances, and has been used for various military applications.
- It also has a coating application in chemical reactions to "set" glues, plastics, and adhesives. Since plastics have many uses, MBOCA is used very widely.

- Inhalation – Likely route of exposure for the general and occupational populations.
- Oral – Likely route of exposure for the general population through ingestion of contaminated food.
- Dermal – Likely route of exposure for occupational population.

### MBOCA in the Environment

- MBOCA is not expected to volatilize from soil.
- It is not expected to transport through soil due to rapid and tight adsorption to organic matter.
- It does not dissolve in water.
- MBOCA is broken down by microorganisms in the soil.
- In air, MBOCA is degraded by sunlight.
- MBOCA is bioaccumulated by food plants grown in contaminated soil.

**Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.**

### Minimal Risk Levels (MRLs)

#### *Inhalation*

- No acute-( $\leq 14$  days), intermediate- (15–364 days), or chronic ( $\geq 365$  days) duration inhalation MRLs were derived for MBOCA.

#### *Oral*

- No acute-( $\leq 14$  days) or intermediate-(15–364 days) duration oral MRLs were derived for MBOCA.
- A chronic duration ( $\geq 365$  days) oral MRL of 0.003 mg/kg/day was derived for MBOCA.

### Health Effects

- Abnormal findings in urinalysis (protein, heme, abnormal cells) have been reported in some workers following occupational exposure to MBOCA. Stomach upset may also be possible.
- In animals, degeneration and dysplasia of the stomach and intestine, elevated liver enzymes, nodular hepatic hyperplasia, hepatic necrosis, renal degeneration and dysplasia of the kidney and urinary bladder were seen following intermediate or chronic oral or dermal exposure.
- A small number of case reports and retrospective occupational cohort studies indicate bladder cancer in humans following occupational exposure.
- In rodents and dogs, chronic oral exposure studies have found increases in neoplastic tumors in the urinary bladder, lungs, liver, mammary glands, Zymbal gland, and vascular system.
- The U.S. Department of Health and Human Services has classified MBOCA as reasonably anticipated to be a human carcinogen. The U.S. EPA has not categorized the carcinogenicity of MBOCA and IARC has categorized MBOCA as carcinogenic to humans (Group 1).

### Children's Health

- It is not known if children are more sensitive to MBOCA exposure than adults. Very young children who have an immature hepatic detoxification system may be affected more.